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Process Monitoring and Performance Evaluation of 10 MLD Sewage Treatment Plant at Kotra

Harish Nema[1], Charan Singh Thakur[2]

[1]Student, Dept. of Civil Engineering, Shri Ram Group of Institution, Jabalpur M.P, India
[2]Professor, Dept. of Civil Engineering, Shri Ram Group of Institution, Jabalpur, M.P, India

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Abstract – *India faces a number of water and wastewater issues and water related health hazards. Sewage Treatment Plants (STPs) have been constructed in most places to reduce the degradation of water quality of the receiving water bodies by reducing the total pollution load on the same and to ensure a healthy environment both aesthetically along with preserving the ecosystem involved. The increasing of population Bhopal District capital of Madhya Pradesh, observed as a result of the development of the modern societies is attended by concerns in the water sector, as a result of the increasing requirements for water supply and wastewater treatment. This situation justifies the evaluation of the system performance that covers protection of water resources & management. Poorly treated wastewater with high level of pollutants caused by poor design of treatment plants, treatment process or maintenance of treatment systems produces major environmental problems, when such wastewater is discharged to surface water or on land. Considering the above stated implications an attempt has been to estimate the performance of wastewater treatment plant (WWTP) near Kotra area at Bhopal capacity of 10 MLD. Waste water samples were collected from inlet and outlet of treatment plant Kotra. Samples were analyzed using pollution indicating parameters such as pH, turbidity, DO, BOD, COD and using standard methods. The results of analysis of waste water indicate that it is highly polluted therefore recommended to treatment and management of the raw / waste water properly for reuse.*

Key Words: **Waste water, Sewage Treatment Plant, DO, BOD and COD.**

1. INTRODUCTION

Water is a finite and essential source of life. Due to the limited sources it is required to be properly manage and recycle. There are important efforts made for improving water management, with main focus on distribution system, storage and sanitation. Rapid population growth has led to an increase of water consumption. Wastewater treatment is a huge universe, and is produced in different conditions with different proportions. For treatment purposes there are available different techniques ; however, there is no treatment system capable of adjusting to all the existing conditions and also with the ability to meet all the demands associated with high quality, energy saving, economical attractive and environmentally non-invasive.

The main purpose of wastewater treatment plants is to protect human health and the environment from excessive overloading of various pollutants. Due to industrial development, domestic effluent and urban run-off contribute the bulk of wastewater generated in Bhopal city. Domestic wastewater usually contains grey water (sullage), which is wastewater generated from washrooms, bathrooms, laundries, kitchens etc. It also contains black water made up of urine, excreta and flush water generated from toilets. Physical, chemical and biochemical processes are applied to remove physical, chemical and biochemical contaminants. Its objective is to produce a waste stream and a solid waste or sludge also suitable for discharge or reuse back into the environment In Bhopal city. According to Bhopal Municipal Corporation (BMC) city sanitation plan, the sewage collection system is decentralized one in BMC area due to new town planning and topographic conditions. The efficiency of wastewater treatment plants can be illustrated by a study on the evaluation of pollutant levels of the influent and the effluent at the treatment plant of sewage treatment plants discharging into the environment.

2. MATERIAL AND METHODS

The present waste water treatment plant (Kotra Waste Water Treatment Plant) is situated in Bhopal, the capital of central Indian State, Madhya Pradesh, within the geographical coordinates of 23° 15' 44'' N, 77° 28' 23'' E. It receives the waste water generated in Nehru Nagar, Kotra Sultanabad and adjoining areas. Kotra waste water treatment plant (WWTP) is designed to treat 10 MLD. The Kotra (WWTP) is based on waste stabilization technique using anaerobic and facultative ponds. Under present study waste water samples were collected from raw sewage and treated water of waste water treatment plant (WWTP) during the period June to December 2017. Samples were analyzed to determine the efficiency of the treatment plant in reducing Biochemical oxygen demand and chemical oxygen demand from the raw sewage and final treated water samples. Wastewater samples were collected in glass bottles, cleaned by washing with non-ionic detergents, rinsed in tap water, in 1:1 hydrochloric acid and lastly with demonized water before usage. Before sampling, the bottles were rinsed two to three times with sample water and then filled and conductivity, total hardness and chemical oxygen demand (COD) were analysis in the analytical laboratory according to the methods prescribed in the APHA9

2. RESULTS AND DISCUSSION

The waste water quality analysis of sewage treatment plant locations, namely, influent of sewage treatment plant Bhopal has been carried out for physicochemical parameters like, pH, turbidity, DO, BOD and COD.

pH-value:-

The high pH values in the month of June may be due to high photosynthesis of micro and macro vegetation resulting in high production of free CO2, shifting the equilibrium towards alkaline side. The pH controls the chemical state of many nutrient including dissolved oxygen, phosphate, nitrate etc. The results of the physicochemical qualities of samples from the different points are as shown in Table 1.

Table No.1: Variation of pH Values

Sr. No.	Sample	Inlet	Outlet
1	JUNE	6.74	7.89
2	JULY	6.75	8.02
3	AUGUST	6.64	7.78
4	SEPTEMBER	6.62	7.58
5	OCTOBER	6.69	7.85
6	NOVEMBER	6.72	7.89
7	DECEMBER	6.64	7.54

The pH ranged from 6.74 to 6.62 during investigation of influent of STP and the treated final effluent water varies from 8.02 to 7.54. These values fall within the World Health Organization limits.

Total Suspended Solids (TSS):-

For a comparison between the mean values of the measured T.S.S in the period from June 2017 to December 2017 are plotted as shown in (Table No .2). The average T.S.S values in raw wastewater recorded 690 mg/l in of influent, of waste water treatment plant. While TSS average value recorded in the effluent in last Cascade Aeration is 117 mg/l respectively. From the figure it is clear that T.S.S concentration values increased in hot seasons and decreased in cold seasons. The reason of these phenomena is that high wastewater in hot season accomplished with high photosynthesis and evaporation rates. High rate of photosynthesis generates many new cells of algae which increases the values of the T.S.S in the ponds.

Table No. 2: Variation of TSS Values

Sr. No.	Sample	Inlet	Outlet	% Removal
1	JUNE	720	124	83
2	JULY	764	132	83
3	AUGUST	710	122	83
4	SEPTEMBER	690	118	83
5	OCTOBER	658	107	84
6	NOVEMBER	640	109	83
7	DECEMBER	644	110	83

Total Alkalinity:-

Monthly variation in Total alkalinity at Kotra waste water treatment plant during in the year 2017 is shown in Table No. 3. During the period Total alkalinity varied from 216 mg/l to 296 mg/l in the raw sewage and 113 mg/l to 167 mg/l in the final treated water.

Table No. 3: Variation of Total Alkalinity

Sr. No.	Sample	Inlet	Outlet	% Removal
1	JUNE	286	167	42
2	JULY	296	163	45
3	AUGUST	290	151	48
4	SEPTEMBER	259	145	44
5	OCTOBER	250	132	47
6	NOVEMBER	223	120	46
7	DECEMBER	216	113	48

Biochemical Oxygen Demand (BOD):-

During the study period the minimum value of biochemical oxygen demand was recorded as 220 mg/L in the month of December, while the maximum value of biochemical oxygen demand was recorded as 448 mg/L in the month of June in inlet 2017 and the minimum value of biochemical oxygen demand was recorded as 50 mg/L in the month of December , while the maximum value of biochemical oxygen demand was recorded as 89 mg/L in the

month of June in the outlet of the sewage treatment plant Kotra in 2017.

Table No. 4: Variation of BOD Values

Sr. No.	Sample	Inlet	Outlet	% Removal
1	JUNE	448	89	80
2	JULY	357	79	78
3	AUGUST	344	76	78
4	SEPTEMBER	279	66	76
5	OCTOBER	290	69	76
6	NOVEMBER	246	65	73
7	DECEMBER	220	50	81

Chemical Oxygen Demand (BOD):-

In the present study period the COD varied from 658 mg/l to 450 mg/l in the influent of sewage treatment plant Kotra and 181 mg/l to 153 mg/l in the effluent of sewage treatment plant Kotra. The minimum value was observed in the month of December while the maximum value was observed in the month of June in the influent of sewage treatment plant.

Table No. 5: Variation of COD Values

Sr. No.	Sample	Inlet	Outlet	% Removal
1	JUNE	658	174	74
2	JULY	591	181	69
3	AUGUST	548	162	70
4	SEPTEMBER	524	153	71
5	OCTOBER	491	156	68
6	NOVEMBER	472	180	62
7	DECEMBER	450	160	64

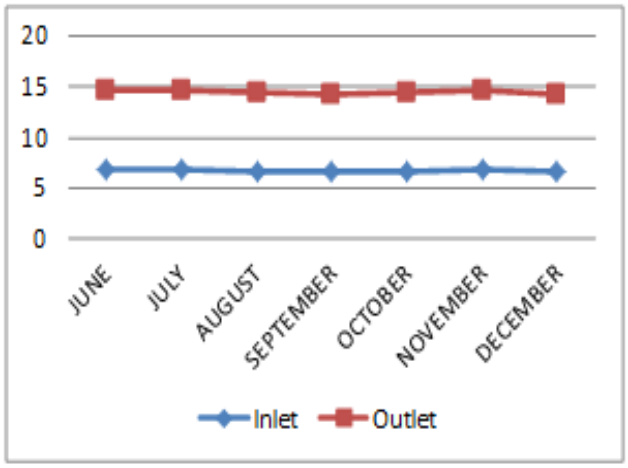

Fig.1: Variation of pH Values in Different Month

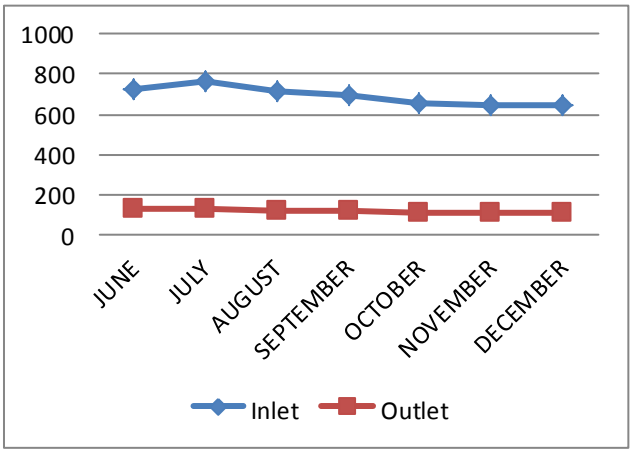

Fig. 2 Variation of TSS in Different Month

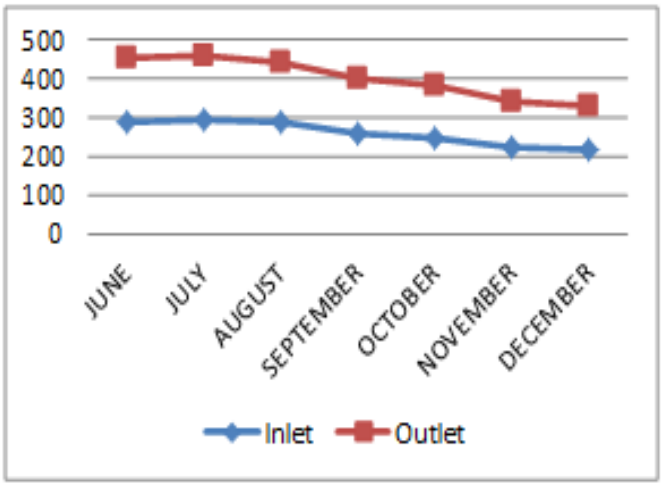

Fig. 3: Variation of Total Alkalinity in Different Month

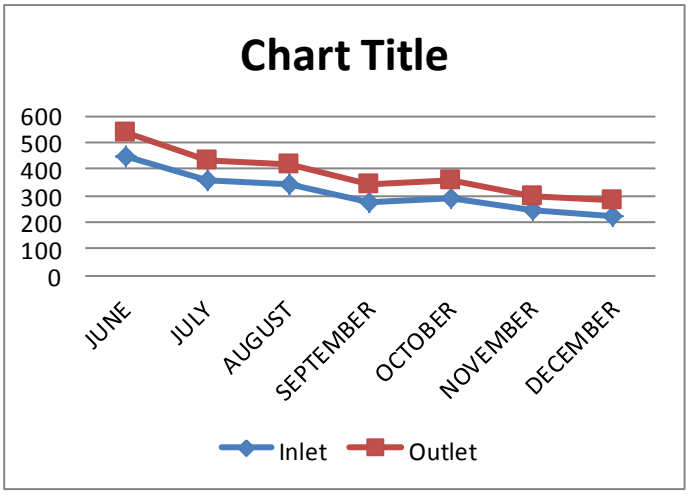

Fig. 4 Variation of BOD in Different Month

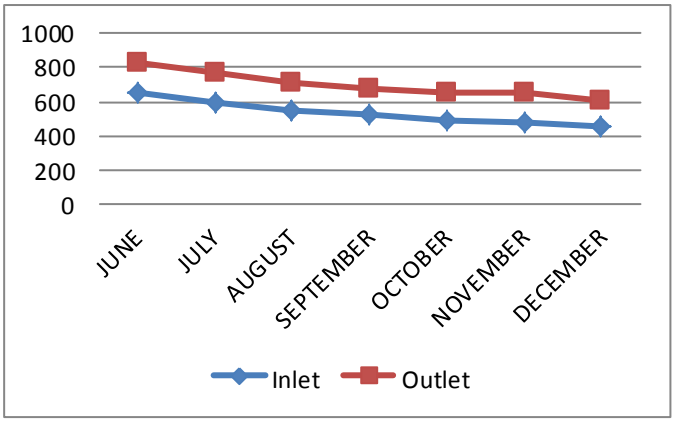

Fig. 5 Variation of COD in Different Month

4. CONCLUSION

Performance analysis of the sewage treatment plant was carried out in order to comment on the efficiency of the plant for treating the sewage water. The present study reveals the assessment of physicochemical parameters like pH Value, TSS, Total Alkalinity and Biochemical oxygen demand (BOD) and chemical oxygen demand (COD) high concentration in raw sewage and low concentration in the final treated waste water due to various stages of waste water treatment plant (WWTP) Bhopal. Performance of Kotra WWTP was evaluated which has shown its capability to reduce TSS, Total Alkalinity and Biochemical oxygen demand (BOD) and chemical oxygen demand (COD) from raw sewage. From the above study, it was observed that high concentration of TSS, Total Alkalinity and Biochemical oxygen demand (BOD) and chemical oxygen demand (COD) was present in the raw sewage however better water quality was found after treatment in final treated water. Instead of discharging the treated water onto the nearby bodies of water, it is proposed.

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